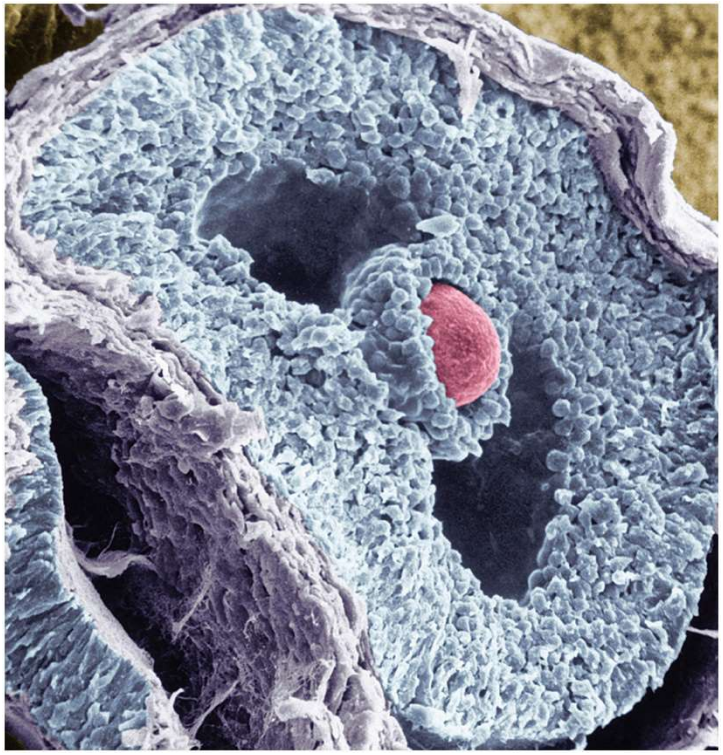
Chapter 18

# Role of the Endocrine System in Stress



# Stress and Adaptation to Stress

- **stress ///** caused by any situation that upsets homeostasis

  - Also anything that threatens one's physical or emotional well-being

  - e.g. // injury, surgery, infection, intense exercise, pain, grief, depression, anger, etc

# Stress and the General Adaptive Syndrome

- **General adaptation syndrome** (GAS)
  - the consistent way that body reacts to stress
  - typically involves elevated levels of epinephrine and glucocorticoids (especially cortisol)
- GAS occurs in three stages
  - **alarm reaction**
  - **stage of resistance**
  - **stage of exhaustion**

# Alarm Reaction

- initial response mediated by
  - norepinephrine from the sympathetic nervous system & adrenal medulla
  - epinephrine from the adrenal medulla
- Response to “fright” and prepares the body to either “fight or flight”
  - stored glycogen is catabolized
  - increase in aldosterone and angiotensin levels
    - angiotensin helps raise blood pressure
    - aldosterone promotes sodium and water conservation
    - Explain why are these secretions appropriate

# Stage of Resistance

- after a few hours, glycogen reserves gone, but brain still needs glucose /// need to provide alternate fuels for metabolism
- This stage dominated by cortisol
- hypothalamus secretes corticotropin-releasing hormone
- pituitary secretes increase amounts of ACTH
  - stimulates the adrenal cortex to secrete cortisol and other glucocorticoids
  - promotes the breakdown of fat and protein
    - glycerol, fatty acids, and amino acids – for gluconeogenesis
    - Need to produce blood glucose for brain and RBCs

# Stage of Resistance

- cortisol has glucose-sparing effect
  - inhibits protein synthesis leaving free amino acids for gluconeogenesis
  - adverse effects of excessive cortisol
    - depresses immune function
    - Increases susceptibility to infection and ulcers
    - lymphoid tissues atrophy, antibody levels drop, and wounds heal poorly
    - Repositions fat deposits in body (from limbs to face & back)

# Stage of Exhaustion

- After stress continues for weeks and months
  - fat reserves are gone
  - protein breakdown results in muscle wasting
  - unable to make antibodies = no longer resistant to diseases
  - homeostasis is overwhelmed
  - Now physiology marked by rapid decline
- Furthermore, associated with loss of glucose homeostasis because adrenal cortex stops producing glucocorticoids

# Stage of Exhaustion

- Aldosterone continues to promoted water retention and hypertension
  - conserves sodium and hastens elimination of $K^+$ and $H^+$
  - hypokalemia and alkalosis leads to death
  - death results from heart and kidney infection or overwhelming infection

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